Energy Charter Protocol on Energy Efficiency and related environmental Aspects

PEEREA

ICELAND

Regular Review of Energy Efficiency Policies 2005

Energy Charter Protocol on Energy Efficiency and Related Environmental Aspects

Iceland

REGULAR REVIEW 2005

Part I:

Trends in energy and energy efficiency policies, instruments and actors

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1. INTRODUCTION

Iceland is a Nordic country, which differs in many ways from other countries. It is the second largest island of Europe and the westernmost part of the continent. The island is mountainous and the central highlands and part of the northwest are uninhabited. The total area is about 103.100 km². Lakes cover about 3% of the island; uncultivated areas (incl. lava fields) about 63%, glaciers about 11% and 23% are vegetated. Thus, only ca. 20% of the land area is inhabited. The population is around 290.000 people and the land is the most sparsely populated country in Europe, with an average of three inhabitants per square kilometer. The Gulf Stream prevents the country from being covered with ice. The average temperature of the summer month is about 12°C (54°F) and of the winter month about 0°C (32°F).

The country utilizes renewable energy sources to a far greater extent than any other country. Iceland's electricity and heating comes from hydroelectric power and the geothermal water reserves tapped from the hot rock layers lying just beneath the surface. Thus, the sources of energy are readily available, easily accessible, renewable and relatively cheap and the pollution is minimal.

The government's policy is to harness these clean and renewable energy reserves, for sustainable development and to further improve the living standards in the country. Out of the total primary energy consumption of 140 PJ in 2003 geothermal power represented 55%, hydropower 18%, oil 24% and coal 3%. The main consumers are industry, followed by househeating, transport and fishing sectors.

The energy consumption per capita is among the highest in the world, due to the power intensive industry, mainly aluminum smelters. However, most of the renewable energy sources are still unharnessed.

The Icelandic electricity market is being liberalised from 2005 according to a new Electricity Act No. 65/2003. The Act is based on EU Directive No. 96/92, concerning common rules for the internal market in electricity and comprehensive legislation on the generation, transmission, distribution and sale of electricity. The objective of the Act is to encourage an economical electricity system by creating a competitive environment for the generation and sale of electricity, encourage efficiency and cost-effective transmission and distribution of electricity, ensure the security of the electricity system and interests of consumers, and promote utilisation of renewable energy sources. The National Energy Authority is the established regulator. A new transmission company has been formed and there are now seven distribution companies.

About 90% of all houses are heated by energy from geothermal resources. This natural resource is also used in various other ways, e.g. for swimming pools, private greenhouses and for heating sidewalks and driveways to prevent ice and snow from settling.

Houses, not connected to geothermal district heating, are heated by electricity and in a few cases by oil. As the cost is typically double compared to heating with geothermal energy, electricity and oil prices for househeating are subsidised. It is also possible for geothermal district heating companies to obtain grants for enlarging their systems in such areas.

Environmental and energy taxes are not included in the energy prices and there is no CO_2 tax.

Fossil fuels are almost exclusively used where it is not technologically feasible to use renewable energy sources, that is in transport and fisheries. These two sectors account for 85% of the oil use. The rest is industrial consumption. Fossil fuels are subject to a value added tax and import duties, as well as a special tariff in the case of gasoline for vehicular use. These duties are geared towards paying for road building and maintenance. There are no environmental taxes on fuel. There are some indirect pollution taxes due to higher import duties on personal cars with larger engines.

It is the Government's policy to promote increased utilisation of renewable energy resources in harmony with the environment. One possible approach towards this goal is production of environmentally friendly fuels for powering vehicles and fishing vessels.

Production and use of alternative fuels has been studied in Iceland for some decades. Studies in the early 1980s indicated that the production and use of alternative fuels would not be economically viable. There has been a renewed interest in the field, particularly in the case of hydrogen that could be produced by Iceland's largely unharnessed renewable energy resources. Considerable hurdles, both technical and economical stand in the way of its use in the near term, however. Innovations and improvements are still needed until hydrogen or other alternative fuels can replace oil in the energy system. A project involving an experiment using three hydrogen-powered buses in Reykjavik is now running in cooperation with DaimlerChrysler, Norsk Hydro and Shell Hydrogen. A commercial hydrogen filling station opened in Reykjavik in April 2003.

The Ministries of Industry and Commerce are responsible for energy efficiency policy and the National Energy Authority, a governmental institute, collects and distributes information about energy use and energy resources. Furthermore, the institute ensures co-ordination with participants in this field, e.g. energy companies, research institutes and universities.

Energy efficiency projects have been based on information campaigns some years ago and also some succesful R&D projects have been running, e.g. for energy savings in the fishing industry and the use of heat pumps. New projects were started in 2004; one of them is aiming for improved energy efficiency in fish farming, another has the objective to promote rational use of energy in the house heating sector and in one of the projects the pros and cons of subsidies for house heating will be estimated and alternative possibilities explored. Furthermore, the establishment of an Energy Agency is planned in 2005.

The generation of electricity is almost exclusively from renewable sources, 7,100 GWh (83%) from hydropower and 1,400 GWh (17%) from geothermal energy. In the next few years the electricity generation will increase substantially with the construction of new geothermal and hydropower plants. The hydropower plant Karahnjukar in the north-east of Iceland will generate 4,600 GWh in 2007 and three geothermal plants in the south-east of Iceland will generate 1,700 GWh in the next two years. The electricity is mostly generated for the power intensive industry, mainly the aluminum industry.

2. BACKGROUND: ENERGY POLICIES AND PRICES

2.1. Energy Policy

2.1.1. General trends and objectives

By international comparison, energy use in Iceland is in a class by itself. Per capita energy consumption is practically the highest known, and the proportion of this provided by renewable energy sources is greater than in other countries. Nowhere else does geothermal energy play a greater role in energy supply, as Iceland is among those nations with the highest utilisation of this energy resource, not only per capita but in absolute terms. In addition to geothermal energy, energy supply in Iceland is based on hydropower and imported fossil fuels. The share of domestic renewable energy resources has grown significantly in recent decades and in 2003, amounted over 70% of the total primary energy consumption. Electricity from renewable sources is 99.9% of produced electricity, 87% of all houses in Iceland are heated by geothermal energy and 60% of energy consumption in industry is from renewable resources.

Increased utilisation of the renewable, indigenous energy sources in Iceland in an economic way has for decades been a high priority for the Icelandic government. This has been debated by several environmental organisations that wants to promote the conservation of the Icelandic nature and protect the country's cultural landscape. In 1999, the government took the initiative of reassesing in detail Iceland's potential for generating electricity in a master plan for utilisation of hydro and geothermal resources.

The objective of the master plan is to evaluate and compare various options of proposed power development schemes and to estimate the impacts they might have on the natural and cultural heritage, the environment, other resources and regional development. This preliminary assesment of impacts helps choosing between power generating options and plans can be altered at an early stage to avoid damaging impacts on the environment without sacrificing cost-efficiency to a great extent. In some locations the protection value is too high and the area might be protected through legislation. This preliminary assesment will not replace the detailed assesment required by legislation on environmental impact assesment, but it gives valuable information at an early stage.

It is the government's policy to continue to exploit natural resources to ensure continuing prosperity in Iceland. As the electricity system is not connected to other countries the energy has mainly been used for power intensive industry. The pioneer venture in energy-intensive industry in Iceland was the construction of the State Fertiliser Plant in 1953. At that time exports were based almost exclusively on fish products. The first aluminum smelter began operating in 1970. The power intensive industry has been growing ever since and recently decisions were taken to greatly increase aluminum production in Iceland during the first decade of the 21st century. This includes the building of an aluminum smelter in east of Iceland and the enlargement of two other plants in the south-west of Iceland.

Fossil fuels are almost exclusively used where it is not technologically feasible to use renewable energy sources, that is in transport and fisheries. These two sectors account for 85% of oil use in Iceland. During the past two decades the fuel consumption has been increasing on average by 1.7% annually. The Icelandic government has emphasized the need

for alternative fuels and the possible utilisation of renewable energy sources for fuel production. The aim is to reduce the dependency on energy imports and increase diversification in the national energy mix when technologically and economically feasible.

The focus in recent years has been on hydrogen and recently the government stated that it will aim at progressing further towards the utilisation of hydrogen; and that in the future, Icelandic energy consumption could be based on renewable energy sources in harmony with the environment, thus becoming sustainable.

Summary Table I: Priority of Policy Objectives

The objectives of the energy policy are prioritised from 1 (the highest) to 5.

Policy objective	Mark
Reduce total final consumption / GDP	4
Reduce dependency on energy imports	2
Diversification of fuels	3
Reduction of CO_2	5
Increase utilisation of indigenous primary energy sources	1

2.1.2. Energy Policy Implementation

The Ministries of Industry and Commerce (the Ministries of Industry and Commerce in Iceland are, according to law, two ministries under one Minister) have the overall responsibility for energy related topics. As in many Northern European countries the energy companies utilizing renewable indigenous resources have been owned by the state and/or municipalities. Thus, the Ministries for Industry and Commerce have had a leading role in the utilisation of energy sources, especially hydro power, as the largest electricity company has mainly been owned by the state. In recent years the largest municipalities have increased their utilisation of geothermal sources, both in direct use of geothermal fluid and for electricity generation.

The Ministries of Industry and Commerce work closely with other ministries including those of Finance (taxation, subsidies), Environment (assesment of environmental impacts, emmisions), Transport (fuel consumption, infrastructure), Fisheries (fuel consumption) and Foreign affairs (fuel consumption, alternative fuels).

The National Energy Authority works under the auspices of the Ministries of Industry and Commerce according to the law no. 87/2003 and the Electricity Act, no. 65/2003. It was formally established in July 1967, having two main areas of responsibility: to advise the government on energy issues and related topics and to carry out energy research and provide consulting services related to energy development and energy utilisation.

Organisational changes were made to the National Energy Authority at the beginning of 1997 and again in 2003, resulting in two institutes: the National Energy Authority (www.os.is) and

the Icelandic GeoSurvey (www.isor.is). The changes seperated advice to the government on energy issues and research services provided in a competitive environment, respectively.

The main responsibilities of the National Energy Authority are: to administrate energy issues and direct research on energy resources in Iceland; to accumulate information, and maintain a database of knowledge on energy resources, their utilisation, and capacity; to collect basic data on hydrological conditions, on the hydrological budget of Iceland's freshwater and geothermal resources, as well as collect data on various natural and environmental processes; to execute all administrative functions as assigned under the Natural Resources Act, the Electricity Act, and other energy-related statutes and to execute administrative functions on behalf of the Icelandic government; to administrate the Energy Fund and the subsidies of energy prices for house heating; and to serve as a governmental advisor on energy issues.

2.2. Energy Prices

2.2.1. Energy Pricing Policy

The utilities in Iceland are owned by the state and/or municipalities. There are eight electricity companies in Iceland. The state power company, Landsvirkjun, has the overwhelmning share of the market. It has recently been split up into an energy production company and a transmission company according to the new law on electricity. There are seven distribution companies. The electricity network is not connected to other countries and due to the abundant amount of renewable energy in the country power intensive industry has increased.

The electricity market has been liberalised with the new Electricity Act no. 65/2003. Large customers can buy their electricity freely from January 2005 and all customers can do so from January 2006. The electricity network service prices (transmission and distribution) are controlled by the National Energy Authority. The prices have to be reasonable and non-discriminatory. Furthermore, the Authority has to protect captive customers during the period of transition. The companies have to separate their monopolistic activities (supply to captive customers and distribution) and competitive activities (eligible customers) and they are not allowed to practice cross-subsidization, that is to impose price increases on captive customers to finance artificial price cuts for eligible customers.

The share of geothermal energy in space heating in Iceland is 87%. In some areas with little amount of geothermal energy the house heating is provided directly by electricity. The share of fuel oil in residential heating in Iceland has been drastically reduced from around 45% in 1973 to about 1.5% in 2003.

The larger district heating companies are owned by municipalities. The companies have been trusted for reasonable price setting and there has not been any regulatory mechanism. However, a new legislation is in preparation that could alter this situation.

There are four oil importing companies in Iceland. Their price setting are watched by the Competition Authority which have the obligation to prevent unfair trade practices, harmful oligopoly and restriction of competition.

2.2.2. Price Levels

Electricity has been sold at various rates in the retail market depending upon what sort of use is involved. This system is different from January 2005 due to new regulations. The National Energy Authority is responsible for the income caps and tariffs for transmission and distribution. The total average electricity price for general use in 2002 was 0.057 USD/kWh.

The electricity price paid by power intensive industries is linked by special agreements to the market prices for products, e.g. the world market prices for aluminum and the USD exchange rate and thus it is prone to fluctuations. The average price in 2002 was 0.014 USD/kWh.

District heating utilities in Iceland are mainly based on geothermal energy, but in a few cases electricity and petroleum fuel is used. Most heating utilities exploiting geothermal energy sell hot water by volume used (m^3). A few still use a tariff system based on maximum flow restriction (liters per minute). The electrically heated utilities on the other hand, sell hot water based on energy (kWh). The calculated space heating costs with geothermal water based on specific assumptions as to the typical user range from 0.007-0.040 USD/kWh. In regions with electrical or oil heating the cost is up to 0.080 USD/kWh. However, electricity for residential heating has from 1982 been subsidized by the state and energy enterprises, to equalize the energy costs. In May 2002 an act on subsidized residential heating costs entered into force. Both electricity and fuel is subsidized according to the new act.

Crude oil prices on the world market have fluctuated greatly in recent years. These fluctuations have naturally been reflected in oil prices in Iceland. The prices for diesel oil and gasoline in November 2004 are 0.8 USD/liter and 1.60 USD/liter, respectively.

A comparison of electricity prices for residential use in Western Europe based on data from Eurelectric from 2003 shows that Iceland has the second-lowest price level. Only in Greece was the price lower. An international comparison of the price for 95-octane gasoline in 2002 based on data from the International Energy Agency (IEA) reveals that gasoline prices in Iceland are among the highest in any OECD country. Only in Norway was the price of gasoline higher.

End prices of imported fuel have generally reflected international market prices. They have had a fairly strong effect on the use of renewables. Longstanding elevated oil prices during the oil crises of the 1970's and 80's gave an economic incentive to drastically increase the use of geothermal energy for district heating – a shift which has not been and will not be reversed.

2.2.3. Environmental levies and taxes

There are no energy or environmental taxes in Iceland and no green pricing.

The taxes on oil and gasoline reflect dues that are imposed to pay for the building and upkeep of infrastructure, not for environmental reasons. Taxes on vehicles do have an environmental aspect related to them. For instance, duties on personal cars with engine volumes greater than 2000cc are 45%, but 30% for engine smaller than 2000cc. In addition, vehicles that use electricity or natural gas as a propellant are eligible for a refund of 1,700 USD off the import duties.

The transmission company pays 0.04 USD/MWh and the distribution companies pay 0.1 USD/MWh as regulatory levies.

120,000 USD per year is used for energy efficiency projects with the main objective to reduce subsidies for house heating.

Summary Table II: Energy Prices

Energy Prices	Yes	No	Partly
Is there an independent regulator of energy prices?			X[1]
Are there any subsidies on energy prices?	X		
Are there any cross-subsidies?		X	
Are the environmental costs fully internalised?		X	
Do you have a tax related to energy consumption?		X	
Do you have a tax related to CO_2 emissions?		X	

[1]Transmission and distribution of electricity

2.3. End-use sectors

The total final energy consumption between 1990 and 2002 increased with 37.8%. This was mainly due to the increase in power intensive industries from 2,133 GWh in 1990 to 5,234 GWh in 2002.

The residential sector's consumption increased with 22.5% in this period. However, the energy intensity measured as use per dwelling or m^2 is fairly constant in the period.

There is a stagnation in energy consumption in the service sector, although the floor area increased by 50% and employees by 27% in this period.

The primary fossil fuel users are the fishing industry and the transport sector. They account for nearly all fuel use of petroleum products and use comparable amounts of petroleum based fuel. Coal is used to a small degree in industry (ferro-silicon production). The total domestic consumption of gasoline and oil remained steady, at around 600,000 tons annually, between 1995 and 2002 with annual fluctuations up to 5%. Domestic oil use increased by almost 7% in the period 1992-2002, and by nearly 20% during the years 1987-2002.

Energy use in the transport sector increased by 17.9% in the period 1990 to 2002. Gasoline consumption doubled, there was a stagnation in domestic air transport and 30% increase in international aviation to and from Iceland.

In the next few years the power intensive industry is growing further in Iceland. The electricity production is increasing by 70% in the next 3 years. The electricity generation by hydropower is increasing from 7,100 GWh to 11,700 GWh in 2007 and by geothermal energy from 1,400 GWh to 3,100 GWh.

3. ENERGY AND ENVIRONMENT

3.1. General trends and objectives

Iceland regards the use of the domestic renewable energy resources to be consistent with the objectives of Agenda 21 and the United Nations Framework Convention on Climate Change both adopted at the United Nations Conference on Environment and Development in 1992. According to the agenda, the government should review energy use with the aim of promoting clean energy and harmonise regional energy programs wherever possible to enable the utilisation of clean energy from new and renewable energy sources.

Iceland aims for all its energy use to be from clean and renewable energy sources.

Iceland´s policy is to further use its abundant domestic energy resources for economic development, diversification of the economy, regional development and environmental benefits derived from using clean and renewable energy. The utilisation of hydro, geothermal and other energy sources should be made by taking into account nature conservation.

The government aims to minimize adverse environmental impacts of both hydro and geothermal plants. Environmental asessment processes are finalised before energy conversion project are committed and used. Various options for harnessing the renewable energy resources are evaluated and the negative environmental impacts they might have are compared. Some areas are valuated so high that they are protected by legislation.

Iceland has developed transportation technologies and considered the relative cost-effectiveness of alternative energy systems. The government working group addressing this issue has submitted policy proposals which will be included in the Local Agenda 21.

A task force composed of the secretary generals of eight government ministries is in charge of formulating and implementing policy with regard to the UN Framework Convention on Climate Change and Iceland´s national programme to halt emissions of greenhouse gases and sequestrate carbon from the atmosphere. Among the single projects that have been undertaken to combat climate change are: the reduction of fluorocarbons emissions from the main aluminum smelter, the provision of electricity to ships in harbours, a change from oil to electricity as an energy source for fishmeal factories, a further expansion of geothermal househeating, the collection of methane from landfills and a project aimed at increasing carbon sequestration in trees and vegetation. Import tariffs on low-polluting engines and vehicles have been lowered. Icelandic authorities have sponsored a joint venture, which will explore possibilities for using hydrogen as a fuel for vehicles and fishing ships. Another programme, sponsored by local authorities in Reykjavik, runs vehicles on methane gas collected from landfill. And finally, as mentioned earlier, a test programme with three hydrogen busses has been running in Reykjavik. The aim is to increase the public awareness of the possibilities for reducing the emission of green house gasses.

Iceland has a programme to implement the Montreal Protocol and has to date conducted the planned phase-out of ozone-depleting substances within the deadlines set in the protocol. The country has an action programme to implement the UN Framework Convention on Climate Change, and has to date undertaken several measures to curb emissions of green house gases and to increase sequestration of carbon in sinks. Iceland has ratified the Kyoto Protocol.

3.2. Environmental Policy Implementation

The Ministry of Environment is responsible for environmental policy related aspects. The climate strategy has been developed in cooperation with the Prime Ministers Office, the Ministries of Foreign Affairs, Finance, Fisheries, Industry, Transportation, Agriculture and the Ministry of Environment.

The Environment and Food Agency operates under the direction of the Ministry for the Environment and was established on January 1, 2003, consolidating the duties of previous related agencies. The Agency aims to sustain public well-being by working towards a cleaner environment, safer consumer products and the improvement as well as conservation of a sustainable environment. The Agency employs a staff of 70, divided into seven divisions: environmental regulation, environmental supervision, food division, nature conservation, wildlife management, the laboratory and finance and human resources.

One of the projects at the agency is monitoring the air qualitity in Iceland. Due to an oceanic climate and steady winds the outdoor air quality in Iceland is generally quite good. Local air pollution is mainly due to road traffic and fishing boats. Iceland is also exposed to transboundary air pollution originating mainly from Europe and North America.

Air quality has been monitored in Reykjavik since 1985 when the Environment and Food Agency of Iceland (EFA) started a measuring station at Miklatorg where airborne dust and heavy metals were measured. The city of Reykjavik Environmental Health and Protection Office (EHPO) initiated another monitoring station at Grensas in 1990, where NO2, CO, O3, SO2, ozone, benzene and dust (PM2.5 and PM10) have been measured. For many years the Grensas station was located for 3 months per year at various sites for special projects, usually 2 - 4 weeks at each location, e.g. at traffic hot spots, kindergartens and different suburban locations. Today the Grensas station serves as the main urban traffic station in Reykjavik due to a contract between EFA and EHPO in 2002 from which time monitoring at Miklatorg was discontinued in 2002.

EFA has also measured background ozone at Keldnaholt in suburban Reykjavik as well as airborne dust in Akranes and Alvidra, both within 50 km from Reykjavik. An urban background station has been running from autumn 2002, in Laugardalur. In addition a portable station is available since 2002, giving data for various locations in the city. Lake Myvatn station in North Iceland was set up in the yar 2000.

3.3. CO_2 emissions

The CO2 emissions from fuel combustion increased from 1990 until 1999. While the CO2 from electricity and heat production, together with house heating, declined the emissions from industry and transport increased. Since 1999 the emissions have been rather stable.

CO_2 emissions from fuel combustion (Gg/year)[1]

	1990	1999	2000	2001	2002
Total CO_2	1672	1905	1808	1782	1854
Electricity and heat production	21	19	14	14	15
Residential	29	22	20	15	14
Industrial	361	467	419	452	453
Transport	600	627	629	640	644
Other sectors	661	770	726	661	728

[1] Source: The Environment and Food Agency

4. ENERGY EFFICIENCY POLICIES

4.1. Energy Efficiency Policy

The government aims to reorganize the energy sector by introducing increased competition in order to increase efficiency and bring down energy prices. At the same time efforts should be directed at making energy tariffs throughout the country similar, and raise the quality of services. Development and research addressing environment-friendly energy sources as hydrogen fuel and methanol will continue. Investments in power intensive industries will continue and cooperation on financing such projects will be sought among both foreign and domestic investors.

Individuals need to be encouraged to show greater responsibility towards the environment. Companies should draw up environmental development policies in order to reduce waste and increase utilisation. An environmental campaign will be launched in which individuals, companies and local authorities will be encouraged to recycle and grade waste.

4.2. Energy Efficiency Targets

The government's policy is to increase the utilisation of the renewable energy sources, hydropower and geothermal energy, in harmony with the environment. Although it is considered to be of great importance to increase the energy efficiency in the various utilisation sectors the targets have not been formulated nor specific goals defined.

The Icelandic government ratified the Kyoto Protocol in 2002. According to that the general emissions of greenhouse gases in Iceland should not increase by more than 10% from the year 1990 to the annual average in the period 2008-2012. Thus the total emissions of greenhouse gases should be less than 3,200 tons CO2 equivalents in this period. Because of the special situation of Iceland with regard to the importance of energy intensive idustry, that is utilising renewable energy sources, the agreement includes a clause that allows Iceland to increase the CO2 emission from energy intensive industry up to 1.600 tons per year in the period 2008-2012.

4.3. Energy Efficiency Priorities

A few years ago information campaigns on energy efficiency were initiated by the Ministry of Industry. The campaigns were especially aimed towards the househeating sector in areas with no geothermal district heating. Many other projects have been running at the initiative of private or public companies or institutes, e.g. for energy savings in the fishing industry, the preheating of motors in cars, the use of heat pumps, various consulting and information campaigns.

New projects on energy efficiency were started in 2004 by the Ministry of Industry and the National Energy Authority. One of them is aiming for improved energy efficiency in fish

farming, another has the objective to promote rational use of energy in the house heating sector and in one of the projects the pros and cons of subsidies for house heating will be estimated and alternative possibilities explored.

Furthermore, the establishment of an Energy Agency is planned in 2005. The main tasks of the Agency will be to promote rational use of energy and the utilisation of renewable energy sources.

4.4. Legal Framework

There is not an energy efficiency law, but in the law regarding subsidies for house heating there is a paragraph about energy efficiency stating that the National Energy Authority shall every year make a proposal for the Ministry of Industry on energy efficiency projects with the aim to reduce the need for subsidies for house heating. It is allowed to use the amount equal to 1% of the annual subsidies for such projects.

4.5. Energy Efficiency Budgets

As stated above the law regarding subsidies for house heating assumes that an amount equal to 1% of the annual subsidies is used for projects that aim at increasing energy efficiency, especially in the building sector. This will in turn lead to reduced requirements for house heating subsidies from the government. Based on the current annual subsidies the amount available for energy efficiency projects is about 100,000 EURO each year.

The establishment of the Energy Agency will be supported by the Intelligent Energy – Europe programme (EIE) that is run by the European Commission. This support also includes the running of the Agency for three years and amounts to totally 200,000 EUR. In addition to this, two of the largest energy utilities in Iceland, Reykjavik Energy (Orkuveita Reykjavíkur) and Iceland State Electricity (Rarik), plan to participate in the project.

4.6. International Co-operation

For several years Iceland has participated in programmes run by the European Commission for support of non-technological actions in the field of energy, mainly rational use of energy and utilisation of renewable energy sources. The current programme of this kind is called Intelligent Energy – Europe (EIE). Iceland has participated in few of the projects supported by this programme and has been responsible for running one of them as a project coordinator (Icelandic Fisheries Laboratory). This project was called “The energy efficiency improvement simulators – Orkuspar” and was aimed at increased energy efficiency in the fishing industry. In addition to Icelandic companies and institutions partners from Sweden and Norway participated in the project. It was finished successfully in May 2003.

As previously mentioned an establishment of an Energy Agency, supported by the ESB/EIE programme, is planned in the beginning of 2005. This will be done in cooperation with two partners from EU-countries that will establish similar Energy Agencies in their home

countries. One of them is Samsoe Island in Denmark and the other is Tenerife, the largest of the Canary Islands, Spain.

Iceland participates in several co-operative projects concerning hydrogen. Iceland is a member of the International Partnership for the Hydrogen Economy; the Hydrogen Implementation Agreement of the International Energy Agency; and is involved with the European Unions Hydrogen and Fuel Cell Technology Platform. There are also several joint research projects, with foreign collaborators, concerning hydrogen being undertaken by private companies, research labs, and academia.

4.7. Energy Efficiency Institutions

The Ministry of Industry is responsible for the energy efficiency policy. The Ministry of Environment is responsible for the building codes.

The National Energy Authority is a governmental institute under the Ministry of Industry. It is responsible for the implementation of energy efficiency policy. Moreover, Iceland is planning for an Energy Agency. Other institutes participate in special projects as for example the Icelandic Building Research Institute, the Icelandic Fisheries Laboratories and the University of Iceland.

4.8. Energy Efficiency Monitoring

The impacts and benefits of ongoing projects will be qualitatively and quantitatively assessed through detailed cost-benefit analysis. The analysis will include monitoring energy savings, environmental impacts and other relevant indicators. Evaluation will be carried out at the end of each year in order to revise the plans and strengthen the actions for next year.

Summary Table III: Energy Efficiency Policies

Energy efficiency policies	Yes	No	Partly
Has an energy efficiency policy been developed?			**X**
Is energy security a driving force for energy efficiency?			**X**
Is climate change/environment a driving force for energy efficiency?			**X**
Is sustainable development a driving force for energy efficiency?	**X**		
Is employment creation a driving force for energy efficiency?			**X**
Is industrial competitiveness a driving force for energy efficiency?			**X**
Is export of technology a driving force for energy efficiency?			**X**
Is comfort perceived as a priority for improving energy efficiency?			**X**
Are international obligations a driving force for energy efficiency?	**X**		
Is there a special fund for energy efficiency?	**X**		
Is there an energy efficiency law?		**X**	
Is energy efficiency incorporated in other legislation?	**X**		
Have national targets been formulated?			**X**
Is there international cooperation in the field of energy efficiency policies?	**X**		

5. ENERGY EFFICIENCY INSTRUMENTS AND MEASURES

5.1. Residential Sector

Table 5.1. Measures and instruments in the residential sector

TYPE OF INSTRUMENTS	PROGRAMME DESCRIPTION AND AIMS	IMPLEMENTATION STATUS	BUDGET*	(EXPECTED) RESULTS
Energy Agency	Establishment of an Energy Agency to promote rational use of energy and the utilisation of RES, with support by the Energy Intelligent – Europe programme	2005		Consumer awareness Energy savings
Mandatory standards	Standardisation – calculation of heat losses from buildings – Icelandic requirements and guidelines built on DS418 (Danish standard), referring to EN-standards.	2005		Reduced energy consumption in new buildings
Information	Initiative of the Ministry of Industry and the National Energy Authority to raise consumer awareness			Consumer awareness, reduced energy consumption in older buildings, especially in areas with no geothermal district heating
R&D	Initiative of the Ministry of Industry and the National Energy Authority to estimate the use of electricity for house heating at various conditions and possible alternatives	2005		
R&D	Initiative of the Ministry of Industry and the National Energy Authority to evaluate the impact of subsidies on EE	2005		

* Please, provide budget in Euros or USD and specify the currency used.

5.2. Industrial Sector

Table 5.2. Measures and instruments in the industrial sector

TYPE OF INSTRUMENTS	PROGRAMME DESCRIPTION AND AIMS	IMPLEMENTATION STATUS	BUDGET*	(EXPECTED) RESULTS
R&D	Initiative of the Ministry of Industry and the National Energy Authority	2004		Reduced energy consumption in fish farming

* Please, provide budget in Euros or USD and specify the currency used.

5.3. Transport Sector

Table 5.3. Measures and instruments in the transport sector

TYPE OF INSTRUMENTS	PROGRAMME DESCRIPTION AND AIMS	IMPLEMENTATION STATUS	BUDGET*	(EXPECTED) RESULTS
R&D	Hydrogen for transport	ongoing		Technical and socio-economic data
R&D	Fuel from biomass	ongoing		Technical and socio-economic data
Legislative	Revised law on diesel oil fees	June 2005		Increased use of small diesel vehicles
Financial	Debate on import duties of vehicles powered with alternative fuel or electricity	ongoing		Increased use of alternatively powered vehicles

* Please, provide budget in Euros or USD and specify the currency used.

Summary Table IV: Measures and Instruments

The types of instruments can include:

1 = information/ awareness (brochures, handbooks, consultations, advice centres etc);

2 = education/training/advisory (consultancy, training on the job, audits);

3 = voluntary agreements (declarations of intent, sector agreements, certification);

4 = research and development (basic research if clearly oriented to energy efficiency in a specific sector, applied research, experimental development);

5 = financial (subsidies, loans, fiscal measures, third party financing);

6 = normative/legislative (laws, permits, labelling, standards, inspections).

	1	2	3	4	5	6
Residential	X	X		X	X	X
Industry	X			X	X	
Services						
Transport	X			X	X	X

6. ACTORS IN ENERGY EFFICIENCY

Table 6.1. Intermediary organisations in the residential sector

RESIDENTAL SECTOR INTERMEDIAIRIES	INTEREST IN KEYWORDS	ACTIVE ROLE IN EE (YES/NO)	IF YES, WITH WHICH INSTRUMENTS
National Energy Authority	Governmental institute	YES	Project implementation
Energy Agency (when operational)	European cooperation in energy efficiency	YES	Energy awareness, improved energy efficiency, reduced greenhouse gases
Icelandic Building Research Institute	Insulation, information, households, buildings	YES	R&D, Information dissemination, standardisation
University of Iceland	Buildings, regulations	YES	R&D, education

Table 6.2. End users in the residential sector

RESIDENTAL SECTOR, END CONSUMERS	INTEREST	ATTITUDE	ABILITY
District heating companies	Energy efficiency	Active	Information
Engineering consultants	Energy efficiency	Active	Consultants, Design projects

Table 6.3. Intermediary organisations in the industrial sector

INDUSTRIAL SECTOR INTERMEDIAIRIES	INTEREST IN KEYWORDS	ACTIVE ROLE IN EE (YES/NO)	IF YES, WITH WHICH INSTRUMENTS
National Energy Authority	Governmental institute	YES	Project implementation
Energy Agency (when operational)	European cooperation in energy efficiency	YES	Energy awareness, improved energy efficiency, reduced greenhouse gases
Icelandic Fisheries Laboratories	Fish farming	YES	R&D: Reduced energy consumption in fish farming
Icelandic Technological Institute	Energy efficiency in fisheries	YES	R&D: Reduced energy consumption in fisheries

Table 6.4. End users in the industrial sector

INDUSTRIAL SECTOR, END CONSUMERS	INTEREST	ATTITUDE	ABILITY
Fish farming	Reduced costs	Active	Test set-up – pilot plant

Table 6.5. Intermediary organisations in the transport sector

TRANSPORT SECTOR INTERMEDIAIRIES	INTEREST IN KEYWORDS	ACTIVE ROLE IN EE (YES/NO)	IF YES, WITH WHICH INSTRUMENTS
National Energy Authority	Governmental Institute	YES	Project implementation
Energy Agency	European cooperation in energy efficiency	YES	Energy awareness, improved energy efficiency, reduced greenhouse gases
Icelandic Technological Institute	Research Laboratory	YES	R&D: Estimating possibilities of alternative fuels

Table 6.6. End users in the transport sector

TRANSPORT SECTOR END CONSUMERS	INTEREST	ATTITUDE	ABILITY
Reykjavik buses	Municipal mass transit	positive	Project implementation
Nýorka	Private company	positive	R&D
Marorka	Private company	positive	EE in ships

7. ASSESSMENT AND FUTURE PLANS

7.1. Successful Instruments

In the residential sector building codes and other mandatory standards have proved to be a successful instrument for improving energy efficiency. This applies for example for insulation of houses as energy prices for house heating are in some areas of the country too low to stimulate good insulation of houses. Also labelling of electrical appliances according to EU-standards that have been used in Iceland for the last few years are considered to be valuable in this respect. Specific energy efficiency programmes run by the government, mainly in the residential sector, have contributed to increased energy awareness among the general public.

7.2. Barriers

The main barrier in the implementation of energy efficiency policy in Iceland is the relatively low energy price level. This is especially true for geothermal heating, although the prices differ a lot according to the local conditions. In spite of the low prices increased energy efficiency in the geothermal sector is considered to be of great importance. This is because the low energy prices are in many cases based on fully developed geothermal fields where the investment costs have already been repaid. Increased utilisation would require development of new geothermal fields and thereby increased energy costs.

7.3. Improvements

In general energy efficiency has a low priority in Iceland. The authorities are aware of this and plan to take measures to improve energy efficiency awareness among the public as well as enterprises. A part of this policy is a new law which assumes that 1% of the budget for subsidies of electrical residential heating is used for energy efficiency measures. As previously mentioned import tariffs on low-polluting engines and vehicles have been lowered. Also the Icelandic authorities are supporting studies on the possibilities for using hydrogen as a fuel for vehicles and fishing ships.

7.4. Recommendations

In connection with the preparation for establishment of an Energy Agency, supported by the EU, the following items have been listed as the main objectives of the Agency:

1. To provide consumers and public authorities with information in the field of energy.
2. To promote rational use of energy, especially in the house heating sector. The aim is to reduce the specific energy consumption for house heating by 10% in a period of 10 years.
3. To help small and medium sized enterprises to improve energy efficiency in their processes and premises.
4. To plan strategies for facilitating increased energy efficiency in each municipality.
5. To reduce the use of fossil fuelled vehicles and promote new concepts in the transport and communication sector.
6. To strive to be a test area for new technology in the field of energy.
7. To transfer new energy via co-operation with other Energy Agencies.

8. CONSULTED SOURCES

1) Ministries of Industry and Commerce, www.ivr.is
2) Ministry of Environment, www.umhverfisraduneyti.is
3) National Energy Authority, www.os.is
4) The Environment and Food Agency, www.ust.is
5) On energy and CO2 data consult IEA publications, www.iea.org:

   Energy Statistics of OECD Countries

   Energy Balances of OECD Countries

   CO_2 Emissions From Fuel Combustion

Energy Charter Protocol on Energy Efficiency and Related Environmental Aspects

Iceland

REGULAR REVIEW 2005

Part II:

Indicators on Energy, Energy Efficiency, Economy and Environment

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a. Introduction

Conversion of units

Units are converted to Mtoe using specific factors for the energy content of each quality of coal, oil etc. In general the net calorific value is used.

Electricity data are converted using the relationship: 1 terawatt hour = 0.086 Mtoe.

b. Macro-Economic Data

Table b.1 Gross Domestic Product

(billion US$95)

	1990	1995	1999	2000	2001	2002
GDP	6.78	6.90	8.31	8.78	9.04	8.98
GDP (PPP)	5.78	5.89	7.09	7.48	7.71	7.63

Sources: Energy Statistics & Balances of OECD Countries 2000-2001, Statistics Iceland

Table b.2. Number of inhabitants

(millions)

	1990	1995	1999	2000	2001	2002
Population	0.26	0.27	0.28	0.28	0.29	0.29

Sources: Energy Statistics & Balances of OECD Countries 2000-2001, Statistics Iceland

c. General Energy Data

Table c.1.

Indicators	Unit	1990	1995	1999	2000	2001	2002
Total Primary Energy Production	Mtoe	1.4	1.57	2.19	2.31	2.45	2.46
Net imports	Mtoe	0.80	0.81	0.93	0.98	0.91	0.92
Total Primary Energy Supply (TPES)	Mtoe	2.17	2.33	3.09	3.24	3.36	3.40
Total Final Consumption (TFC)	Mtoe	1.72	1.79	2.15	2.26	2.28	2.37
TFC/GDP	toe/US$	0.25	0.26	0.26	0.26	0.25	0.26
Total Electricity Consumption	TWh*	4.12	4.65	6.80	7.37	7.68	8.00

Sources: Energy Statistics & Balances of OECD Countries 2000-2001, National Energy Authority

* 1 Mtoe = 11.63 TWh

d. Sector Consumption: Parameters and Energy Efficiency Indicators

Table d.1. Total Final Energy Consumption (TFC) by end-use sector

(Mtoe)

Sectors	1990	1995	1999	2000	2001	2002
Residential	0.40	0.41	0.44	0.44	0.48	0.49
Industry	0.39	0.40	0.64	0.73	0.76	0.79
Services	0.19	0.18	0.17	0.18	0.19	0.19
Transport*	0.28	0.28	0.34	0.36	0.34	0.33
Agriculture	0.29	0.32	0.32	0.31	0.28	0.30
Others**	0.14	0.14	0.15	0.14	0.11	0.17
Total (TFC)	1.69	1.73	2.06	2.16	2.16	2.27

Sources: National Energy Authority
* Road transport, inland waterways, domestic and international aviation
** Others include Non-specified other sectors and Non-energy use

Table d.2. Energy Efficiency Indicators for Households: Final Consumption of the Residential Sector by Energy Source

(Mtoe)

Indicators residential sector	1990	1995	1999	2000	2001	2002
Total Final Consumption	0.40	0.41	0.44	0.44	0.48	0.49
a. Electricity	0.05	0.05	0.05	0.05	0.05	0.06
b. Heat*	0.05	0.10	0.11	0.10	0.10	0.14
c. Oil products	0.02	0.01	0.01	0.01	0.01	0.01
d. Gas						
e. Coal						
f. Combust. Renew. & Waste						
g. Others**	0.28	0.25	0.27	0.28	0.33	0.29
Floor Area ('000 m^2)	15300	16800	18300	18600	18900	19100
No. of dwellings (x 1000)	90	97	103	105	106	108
Residential use per dwelling (toe/dwelling)	4.43	4.19	4.24	4.22	4.55	4.50
Residential use per surface (toe/m^2)	26.05	24.20	23.88	23.84	25.53	25.47

Sources: National Energy Authority
* Hot water from CHP- and Heat-stations
** Direct used geothermal energy

Table d.3: Final Consumption of the Industry Sector by Energy Source in 2002

(ktoe)

Indicators industrial sector	Mining	Manufacturing							Construction	Total
		Iron and steel	Chem. and petrochemical	Non- ferrous metals	Food and tobacco	Paper pulp and print	Non- metallic minerals	Other		
Coal		89					9			98
Petroleum products				7	62				59	128
Gas										
Electricity	1	89	2	359	37	1	3	6	2	501
Heat / Geothermal	55									55
Combust. Renew.&Waste										
Total	56	178	2	366	99	1	12	6	61	781
Value added per sector (1995 USDx10^6)										
Energy/value added (Mtoe/ 10^6 USD)										

Sources: National Energy Authority

Table d.4. Energy Efficiency Indicators for Services (commercial and non-commercial): Final Energy Consumption of Services by Energy Source

(Mtoe)

Indicators services sector	1990	1995	1999	2000	2001	2002
Total Final Consumption	0.19	0.18	0.17	0.18	0.19	0.19
a. Electricity	0.05	0.05	0.06	0.07	0.07	0.07
b. Heat *	0.02	0.04	0.03	0.03	0.03	0.04
c. Oil products						
d. Gas						
e. Coal						
f. Combust. Renew. & Waste						
g. Others **	0.12	0.09	0.08	0.08	0.10	0.08
No. of employees (‘000)	75	79	87	90	93	95
Floor area (‘000 m^2)	4305	4975	5993	6168	6369	6451
Value added (10^6 USD)						
Energy/value added (Mtoe/10^6 USD)						
toe/Employee	2.57	2.23	1.96	2.02	2.08	2.03
toe/m^2	0.04	0.04	0.03	0.03	0.03	0.03

Sources: National Energy Authority
* Hot water from CHP- and Heat-stations
** Direct used geothermal energy

Table d.5. Transport indicators (2002)

Indicators transport sector	Freight	Travel	Total
Total Final Consumption (Mtoe)			0.33
10^9 Tonne-km		-	
TFC/10^6 tonne-km		-	
10^9 Person-km	-		
TFC/person-km (TFC/10^6 person-km)	-		
Number of cars/1000 inhabitants	70	561	631

Sources: Energy statistics & Balances of OECD countries 2000-2001, National Energy Authority, Energy Forecasting committee

e. End-Use Energy Prices for Various Market Sectors

Table e.1. Energy prices end use sectors 2002

(USD per Unit)

Sectors	Un-leaded gasoline 95 RON (litre)	Light fuel oil ('000 litres)	Diesel (litre)	Heavy fuel oil (tonne)	Nat. Gas (10^7 kcal GCV*)	Steam Coal (tonne)	Electricity (KWh)
Industry			0.27	278.39			0.057(General Industry)/0.014 (Power Intensive Industries)
Households (Incl. …% VAT)	1.03(24.5%VAT)	430.48(14%VAT)	0.51(24.5%VAT)				0.09(24.5% VAT)
Electricity generation	-						-

* Gross Calorific value
Sources: National Energy Authority

f. CO_2 Emissions

Table f.1. CO_2 emissions from fuel combustion

Indicators	1990	1999	2000	2001	2002
Total CO_2 emissions (Mtonnes/year)	1.672	1.905	1.808	1.782	1.854
Share electricity and heat production (%)	1%	1%	1%	1%	1%
Share residential sector (%)	2%	1%	1%	1%	1%
Share industrial sector (%)	22%	25%	23%	25%	24%
Share transport sector (%)	36%	33%	35%	36%	35%
Share other sectors (%)	40%	40%	40%	37%	39%
Total CO_2/GDP (tonnes/mill. USD '95)	0.28	0.25	0.25	0.23	0.23
Total CO_2/capita (tonnes/inhabitant)	7.83	7.50	7.86	7.38	7.24
Total CO_2/ TFC (tonnes/toe)	0.95	0.68	0.68	0.63	0.62

Sources: CO_2 Emissions from Fuel Combustion (2000 Edition), National Energy Authority (www.os.is) and Environment & Food Agency (www.ust.is)